Soft Shell Clam
Propagation
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In the spring of 2000 the Marine Department prepared to conduct experimental propagation of soft-shell clams through the use of netted enclosures. These soft-shell clam cages were placed in four different areas around Nantucket Harbor to test for growth, mortality, and the reproductive capacity of the area. Also being tested was the effectiveness of the cages, which were designed to catch larval clams and protect their development against predators. These four areas were chosen based on previous knowledge of the harbor, map study, and site observation (see map #1).

Construction of the cages began on 5/22/00 with the use of materials found at the Boat House and extra parts purchased from the Marine Home Center. The enclosure basically consisted of a 4'x 6' box frame of 2"x 6" boards covered by a layer of screen and thicker mesh, which is held up by hooped strapping (see fig. #1). The cage was held down with concrete blocks tied to the sides, and metal rebar driven into the sand or mud. To set up the experiment we first excavated a suitable 4'x 6' area of all soft-shell clams, shells, and other debri. Then 24 soft-shell clams were placed back into that area, 1 at the center of each square foot. Later at the end of the summer, well after the spawning, we would return to re-excavate half the area. By counting the number of clams there then, we could get a good estimate on the reproductivity, growth and mortality for that area. Given this knowledge we could then make an assessment on the effectiveness of the cage.

On 6/2/00 we deployed Cage #1 inside the first inlet leading away from Polpis Harbor toward the west side of Pocomo. As with the other cages this was done at low tide, expecting the area to be totally covered by high tide. From this site 36 clams were removed, and 24 replanted; each one replanted was approximately 3" to 4" in length. Cage #2 was placed just inside the entrance to Coskata Pond on the 5th of June. At this station the substrate was sandier, with fewer soft-shell clams than the area of Cage #1. In the excavation we found only 4 soft-shell clams, however there were twice as many Quahogs. The remaining soft-shell clams needed to fill the enclosed site were gathered from the surrounding area, and were also approximately 3" to 4" in length. Cage #3 was placed on the east bank to the entrance of Polpis Harbor during the same week as Cage #2, on the 8th. Originally the west bank was chosen because it was a larger area, but it tuned out to be too rocky and filled with wormholes. The site on the east bank proved to very prodigious with 44 soft-shell clams excavated from this 4'x 6' area. This substrate consisted of a sandy/muddy bottom, mixed with decaying vegetation. This site was also directly adjacent to the shoreline, and the dense marsh grass that grew there. Lastly Cage #4 was placed up inside an inlet inside 1st Bend, just west of 2nd Point. This was an area of very soft sand with very little mud or organic matter. Here we found 48 soft-shell clams in a 4'x 6' area, but 4 were broken during excavation due to very thin and brittle shells.

Many problems occurred throughout the spring and summer with the cages due to wave and storm action. Also because of the materials used the cages were excessively buoyant and would rise off the rebar stakes that had been driven into the mud or sand to hold them in place. Storm action on one occasion even ripped Cage #2 free from it's concrete blocks and left it on the far east side of Coskata Pond. Similar events occurred with Cage #1 twice, and Cage #3 was often popping off it's stakes. Cage #4 suffered the least amount of disturbance, and actually settled into it's location nicely. In some cases more rebar stakes were added or stronger ropes were tied to the concrete blocks. These

repairs and additions usually took care of the problem, however it was determined that a better design was needed for the future.

By the end of August we were ready to remove our cages and check the results. The soft-shell clams had gone through the spawning process and the juveniles had grown large enough to count. We first removed Cage #3 from the mouth of Polpis Harbor on the 29th of August. We excavated half of the enclosed area for counting and found 27 live and 5 dead soft-shell clams. The living clams were between 2" and 4" long, and the dead clams were between 2" and 3". The total reproductivity from 12 clams to 32 clams for that area was calculated to be 166%, with a total mortality of 15%. The additional 20 clams found in that area had grown approximately 2" since the time they had been spat in June. Also of note was the odd shape of the clams, many were extremely fat with strange bulges and indentations along the shell. A dark black organic like residue also covered most shells and was believed to be the result of the location.

On August 31st Cage #4 was retrieved from 1st Bend on Coatue. Half of the enclosed area was excavated finding 44 soft-shell clams in total, 41 were alive and 3 were dead. This resulted in a 266% increase in reproductivity, and a 6.8% mortality. Most clams were approximately 2" in length, and the original dozen were between 3 ½ " to 4" in length. This cage did show signs of disturbance as some of it was under cut by tide and wave action, however it did not seem to be enough to have affected the clams.

On the 1st of September Cage #1 was removed from it's station inside an inlet south of Pocomo Pt. Approximately 21 dead clams were found in a 3'x 4' area from this enclosure. There is believed to have been an increase of 75% in the population here, however there is also believed to have been a complete die off. It appeared that a storm had created so much wave action that the entire cage had been heavily under cut. The erosion would have been enough to kill all the clams present by exposing them to the surface, resulting in a 100% mortality. The presence of 9 (2" clams) would indicate that reproduction had occurred, and many more may have survived if the cage and storm had not resulted in so much erosion.

The last cage was retrieved from the Coskata Pond inlet on the 6th of September, and half of it's enclosed area was excavated. Cage #2 was also nearly a complete loss as only 3 live clams were found. There were 72 dead clams dug up, measuring between 1" and 4 ½", however most were approximately 2" in length. Though a 500% increase would have made this the most reproductive area, erosion resulted in nearly 100% mortality. The same problems as with Cage #1 must have occurred here also, and this was ultimately due to the design of the cage, and the relative openness of the area. It should also be noted that the mouth of Coskata Pond had changed dramatically over the summer, it's sand bars shifting to entirely new locations.

Results:

1: Cage#1, Pocomo. 75% reproductivity.
2: Cage#2, Coskata. 500% reproductivity.
3: Cage#3, Polpis. 166% reproductivity.
4: Cage#4, 1st Bend. 266% reproductvity.

Conclusions to be drawn from soft-shell Clam propagation are that it can be successful if many prerequisite conditions are met. Environmental conditions are best

when the area chosen receives full tidal fluctuations, but at the same time is well protected from direct effect of wind and waves. A mix of sand and mud in the substrate seems to be best if there is not a lot of organic matter, rock, and clam worms present. A less buoyant cage with a smaller surface area would also be more effective and less likely to be affected by wind and wave action. All the areas chosen for propagation showed potential for good reproductivity, but the means to ensure this need to be further investigated. The time needed to seed an area seems relatively short, as it only took the clams three months to grow out to approximately 2" in length. So an area greatly depleted of S.S. clams could easily be rejuvenated with little effort if well monitored. And with the development of more effective cages, propagation in the future could be very successful.